CLAIM REJECTIONS

Claims 1-3, 7 and 9 were rejected as obvious over Ross, US 4,946,656

Claims 4 and 5 were rejected as obvious over Ross in view of Chitnis, US 5,681,450.

Claim 6 was rejected as obvious over Ross.

Claim 8 was rejected as obvious over Ross in view of Lomas, US 5,584,985.

Claims 10-13 were rejected as obvious over Ross in view of Chitnis.

Reconsideration is respectfully requested in view of the attached publication, the Declaration of inventor Owen, and the remarks which follow.

50 YEARS OF CATALYTIC CRACKING is attached. It is a publication of Inventor Owen which gives a good readable overview of the evolution and development of catalytic cracking, starting with fixed bed cracking (Houdry process), progressing to moving bed cracking and ending with fluidized bed catalytic cracking (FCC). This publication is condensed but a similar story could be told by following some of Owen's patents on FCC, which span much of this period. (Mr. Owen has over 250 patents since 1976, primarily on FCC, and many before this which cannot be efficiently searched on the PTO WWW site.

In retrospect, every improvement is arguably obvious. Now it is obvious that fixed bed cracking, being cyclic, was not very efficient and that a continuous or moving bed process is better, but it took years to go from fixed to moving bed cracking units. Now it seems obvious that finely divided catalyst (fluidized) would suffer less diffusional restraints than much larger beads of catalyst (moving bed), but it took decades for the superiority of FCC to be accepted and decades more for refiners to shut down their moving bed units.

FCC technology evolved, too. FCC started with dense bed cracking, and only after decades did refiners realize that the good reactions occurred in seconds. It was better to do the cracking reaction in seconds in the riser rather than in minutes in a dense bed.

To be fair, some developments went slowly because of other constraints in the process. Catalyst manufacturing improved, and catalysts became more stable. Catalyst activity exploded with the advent of zeolite cracking catalyst. Regenerators then ran hotter.

These developments (more active catalyst, shorter cracking time) created conditions which allowed wonderful theoretical yields that were hard to obtain in commercial practice. Refiners wanted to maximize catalytic cracking to take advantage of the wonderful zeolite catalyst and wanted to minimize thermal cracking, which degraded the products of catalytic cracking and converted minor amounts of these products into really troublesome materials such as dienes. The new catalysts were not making dienes. The high temperatures used and long residence times in some portions of the FCC unit were thermally cracking the newly cracked product.

Refiners continued the march to shorter time catalytic cracking, a journey which started with riser cracking and progressed significantly with "closed cyclones", which rapidly separated catalyst from cracked product exiting the riser. The cracked product could be quickly removed and sent to the main column. If catalyst-cracked product separation exiting the riser were perfect, this would be the end of the journey, but in life and in FCC, things were not so simple.

The FCC process uses enormous amounts of catalyst, typically 5 or 10 tons of catalyst per ton of fresh feed charged to the riser. Much cracked product ends up in the spent catalyst discharged from the riser cyclones. Some product is "aspirated" away by the down-flowing catalyst and other product present in the pores of the cracking catalyst is lost. For over half a century, so much product remained in spent catalyst that all FCC units have used a "stripper" to remove the last bits of product from around and inside the catalyst. In theory only spent catalyst, rather than a mixture of spent catalyst and entrained or adsorbed cracked product is sent to the regenerator.

The amount of product recovered from the stripper is an order of magnitude less than that discharged from the riser. The stripper "product" however spends a significant amount of time at high temperature, and this small stream is significantly degraded by thermal cracking. Because the FCC riser and the stripper run hot, thermal cracking of product occurs in the stripper and the vapor region above the stripper.

FCC reactors and strippers are complicated, physically crowded, and worked very hard. The environment is harsh like being in a sandblaster for years. There are space constraints in existing units that make it difficult to add much new hardware. One might devise a way to build a completely new unit with an elegant stripper in a separate vessel on the side to provide a way to rapidly remove stripper vapors so that undue thermal cracking is avoided, but the last new refinery in the US was built in 1976 at Garyville, LA, and the existing ones have little room for new strippers.

There has been a long-felt need for a better way to get stripper vapors rapidly out of the reactor or the region above the stripper. The device has to be simple and reliable, and reasonably priced Refiners can only afford to put in improvements which have a rapid payout and low risk.

THE SNORKEL

Inventor Owen discovered a way to get stripper vapor quickly out of the reactor in a way which was compatible with most existing FCC units. Put in a snorkel and suck out the cracked products stripped from spent catalyst. Rely on fluid dynamics, rather than an expensive containment vessel to isolate and remove cracked product before it can be degraded. It is an elegant solution to a decades old problem.

Some tried to minimize thermal cracking by adding enormous amounts of quench material near the top of the riser. Others tried to "cool it" and reduce thermal cracking by quenching the stripper vapor with water or steam (Krambeck, et al US 5,978,440 addresses this problem). Krambeck was based on applications filed in 1984.

Inventor Owen realized that it was better to get product out quickly via his snorkel, rather than quench enormous amounts of material in the riser or the modest amounts of material discharged above the stripper.

US 4,946,656 Ross et al is directed to the same problem – cracking of stripper vapors in the vessel volume above the stripper. Ross "isolates" the stripper, using a "stripper cap and chimney

vent …Without … (them) the stripped hydrocarbons would pass through the entire reactor vessel atmosphere to result in a longer residence time." Col. 3, lines 54 – 60.

Ross, in effect, builds a separate stripper vessel within the confines of an existing FCC unit, isolating the stripper with a stripper cap, and creating some problems, namely how to get the spent catalyst into the stripper and how to get the stripper vapors out. The approach, a "containment vessel" within the reactor vessel, requires a circumferential weld to maintain, cyclones to seal and the riser itself to seal. The device requires extensive field fabrication, makes it harder to work on stripper internals and injects a significant element of risk, that the whole thing will fail as temperatures rise and fall and as the device is sandblasted for years by the catalyst.

The examiner rejected the claims, saying it is obvious to omit an element, as "the function of the element is not desired…"

The examiner's position is not understood. Both Ross and Inventor Owen try to solve the same problem – thermal cracking of stripped product. Ross requires a complicated device that creates many clearance and thermal expansion problems. Owen finds a way to do it simply, leaving the stripper in open fluid communication with the space above the stripper. The old reactor design can be used without extensive internal rebuilding.

Chitnis US 5,681,450 is directed to a third stage separator (TSS) – it is remote from the FCC stripper. Chitnis mentions conventional cyclones as part of a general review of cyclones, but the problem solved by Chitness was "The troublesome separation is downstream of the regenerator in the … (TSS). The TSS must produce gas with essentially no particles greater than 10 microns (when power recovery turbines are used) and/or achieve sufficient removal of fines to meet emissions particulates regulatory limits." Col. 5, lines 50 – 58.

Chitnis used conventional cyclones and presumably a conventional stripper. He focused on getting minute amounts of sub-micron fines out of regenerator flue gas. This is physically and conceptually remote from what goes on in the catalyst stripper where minute amounts of product are removed from tons of catalyst particles 60 – 80 microns in size.

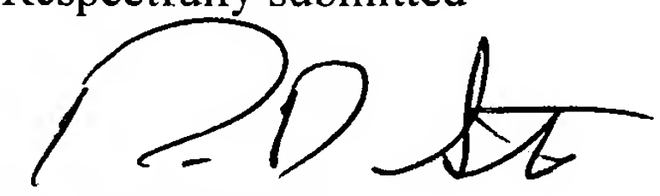
Lomas US 5,584,985 teaches using vapor discharged from the cyclones as a stripping medium of some sort. "The cracked gases from the dip legs of the cyclones are particularly effective as stripping gases since they have undergone cracking to the point of being essentially inert as a result of the long residence time in the cyclone dip legs." Col. 4, lines 3 – 7. Lomas uses over-cracked hydrocarbons as a stripping medium - sending cracked hydrocarbons **BACK** to the stripper, the opposite of Owen's approach, which quickly removes cracked hydrocarbons **FROM** the stripper.

These references considered as a whole teach away from the claimed invention. Ross isolates the stripper, putting an annular cap on it. A reference which teaches the importance of a containment vessel does not make it obvious nor disclose how to remove stripper vapor without a containment vessel. Chitnis, directed to an improvement in the TSS unit associated with a catalyst regenerator, is physically and conceptually remote from an FCC stripper. Lomas, teaches a separate vessel for the stripper. It does not suggest using a snorkel to get cracked product rapidly away from a stripper. Lomas sends cracked product back to endure more time at high temperature, the opposite of Owen's rapid removal approach.

TELEPHONE INTERVIEW INVITED

If Examiner Douglas believes the claims contain patentable subject matter, but has concerns over claim language, a telephone interview is invited.

Respectfully submitted



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